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Interactive comment on "Atmospheric boundary layer dynamics from balloon soundings worldwide: CLASS4GL v1.0" *by* Hendrik Wouters et al.

Anonymous Referee #2

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The paper presents a significant advancement in producing both useful accessible boundary layer data from radiosondes, and a nice marriage with a simple ABL model to produce continuous ABL data constrained by analyses, with open-source software.

I was not able to fully run the CLASStGL software myself. On a Mac using MacPorts, the PyYAML was not available and I downloaded directly from the website - there were issues recognizing the CLoader option - apparently a version inconsistency. But I will follow through as I would like to use this tool.

Regarding the manuscript, I suggest only minor changes are needed (editorial and regarding content), as outlined below:

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Discussion paper

P3 L14: Use "automates" instead of "automises". Likewise on P4 L7.

P4 L3: Change "dirunal" to "diurnal"

P5, L10-11: It is a common assumption that the heat, moisture and momentum content of the ABL are perfectly mixed, but of course there will be mean vertical gradients, especially near the entrainment zone and the surface. In other words, the gradients here are a little weaker than for a well-mixed ABL, which may be compensated by other parameter choices. What would be the effect of specifying more realistic but still simple tails (e.g., exponential or even linear) of theta, q and V at the top and bottom of the ABL? This will relate to comments below regarding apparent biases.

P7 L4-10: Please state how many (or what percentage) of the 42,000 profiles are excluded for each reason (lacking both 00 and 12UTC soundings vs. non well-mixed profiles? The first seems a hard criterion, but exactly how well-mixed is that criterion and what if it is relaxed?

P7 L12: Change "says" to "days".

P7 L13-17: Are there clear discrepancies between the behavior and/or statistics of gap-filled (model) versus observationally driven results? I assume you have looked at this - a caveat might be warranted here.

P10 L8: Change "reassure" to "assure".

Figure 3: There is only a circle (All) for dq/dt - not the other rates. Is something missing?

P12 L6: Here I start wondering about the sources of biases and if you have been able to examine them. For dq/dt, a positive evaporation bias, excessive low-level moisture flux convergence (in the boundary conditions) or too little entrainment of dry air could each explain this. Has it been investigated? Is it likely a problem with the model or forcing data?

Fig 4 and associated text: If the heating and moistening rates are converted to J/kg/h by

multiplying by C_p and lambda_v respectively, we get that the heating bias is -52 J/kg/h but the positive moistening bias is 175 J/kg/h. The discrepancy is 123 J/kg/h – again there could be multiple sources of this. First thought is net radiation, but excessive ground heat flux from the soil, advection (convergence) or entrainment could all be reasons. Any idea about the source of this net energy bias?

P13 L25-29: Related to above, a nice speculation on causes, but atmospheric models including reanalyses tend to have too much surface net radiation due to cloud errors and lack or proper representation of aerosol effects. R_Net or the input ERA-I radiation should be validated against independent data (e.g., the available CERES data) as a sanity check.

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